# Subject Code: 01ME0732
# Subject Name: Renewable Energy Engineering
# B. Tech. Year - IIII (Semester - 7)

**Type of course :** Program Elective

**Prerequisite :** Fluid Mechanics, Heat Transfer

**Rationale :** The course is designed to give knowledge of various renewable energy sources, systems and applications in the present context and need.

**Course Outcome :**
After learning the course, the students will be competent
1. Importance of RE sources
2. Applications of different RE sources
3. Carry our preliminary economic analysis of RE systems

**Teaching and Examination Scheme :**

| Teaching Scheme | | | Credits | Examination Marks | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Theory Marks | | | Practical Marks | | Total Marks |
| Theory | Tutorial | Practical | C | ESE (E) | IA | CSE | Viva (V) | Term Work (TW) | |
| 4 | 0 | 2 | 5 | 50 | 30 | 20 | 25 | 25 | 150 |

**Content :**

| Sr. No. | Content | Total Hrs |
|---|---|---|
| 1 | **Scenario of Renewable Energy (RE) Sources:** Needs of renewable energy, advantages and limitations of RE, present energy scenario of conventional and RE sources | 2 |
| 2 | **Solar Energy:** Energy available from the sun, spectral distribution, solar radiation outside the earth's atmosphere and at the earth's surface, solar radiation geometry, Instruments for solar radiation measurements, empirical equations for prediction of availability of solar radiation, radiation on tilted surface<br>solar energy conversion into heat, types of solar collectors, evacuated and non-evacuated solar air heater, concentrated collectors, thermal analysis of liquid flat plate collector, air heater and cylindrical parabolic collector, solar energy thermal storage, heating and cooling of buildings, solar pumping, solar cooker, solar still, solar drier, solar refrigeration and air conditioning, solar pond, heliostat, solar furnace<br>photovoltaic system for power generation, solar cell modules and arrays, solar cell types, material, applications, advantages and disadvantages | 22 |

| | | |
|---|---|---|
| **3** | **Wind Energy:** Energy available from wind, basics of lift and drag, basics of wind energy conversion system, effect of density, angle of attack and wind speed, windmill rotors, horizontal and vertical axes rotors, drag, lift, torque and power coefficients, tip speed ratio, solidity of turbine, wind turbine performance curves, wind energy potential and site selection, basics of wind farm | **12** |
| **4** | **Bio Energy :** Types of biogas plants, biogas generation, factors affecting biogas generation, advantages and disadvantages, biomass energy, energy plantation, gasification, types and applications of gasifiers | **03** |
| **5** | **Ocean Energy**: OTEC principle, open, closed and hybrid cycle OTEC system, Energy from tides, estimation of tidal power, tidal power plants, single and double basin plants, site requirements, advantages and limitations, wave energy, wave energy conversion devices, advantages and disadvantages, ocean thermal energy<br>**Geothermal energy**: Introduction, vapor and liquid dominated systems, binary cycle, hot dry rock resources, magma resources, advantages and disadvantages, applications<br>**MHD Power generation:** concept and working principle | **08** |
| **6** | **Economic Analysis:**<br>Initial and annual cost, basic definitions, present worth calculations, repayment of loan in equal annual instalments, annual savings, cumulative saving and life cycle cost, economic analysis of add on solar system, payback period, clean development mechanism | **09** |

**Distribution of Theory Marks**

| **R** Level | **U** Level | **A** Level | **N** Level | **E`** Level | **C** Level |
|---|---|---|---|---|---|
| **20** | **30** | **25** | **15** | **10** | **--** |

**Legends: R:** Remember**; U:** Understand**; A:** Apply**; N:** Analyze**; E:** Evaluate**; C**: Create

**List of Experiments :**

Practical should be designed to include study of various RE systems.

1. To study the scenario of renewable energy
2. To study wind energy conservation system.
3. To study instruments used for measurement of solar radiations.
4. To study of solar collectors.
5. To study solar energy application.
6. To study about ocean thermal energy conversion system & Tidal energy Power plant
7. To study of Geothermal power plant
8. Application of Virtual Lab for study of Renewable energy

**List of Assignment :**

Assignment should be designed to include all the units.

1. Scenario of renewable energy
2. Solar energy
3. Wind energy
4. Ocean & Geothermal energy

5. Economics analysis

**Major Equipment :**

1. Solar water heater
2. Pyranometer
3. Solar PV system
4. Wind mill
5. Solar cooker

**Reference books :**

1. Solar Energy: Principles of Thermal Collection and Storage, S. P. Sukhatme and J. K. Nayak, McGraw- Hill Education
2. Solar Engineering of Thermal Processes, John A. Duffie, William A. Beckman, John Wiley, New York
3. Non-conventional energy resources, ShobhNath Singh, Pearson India
4. Solar Energy Engineering, SoterisKalogirou, Elsevier/Academic Press.
5. Principles of Solar Energy, Frank Krieth& John F Kreider, John Wiley, New York

**List of Open Base Software/learning website :**

1. http://nptel.ac.in/courses/112104117/18
2. http://nptel.ac.in/courses/112104117/4
3. http://nptel.ac.in/courses/112104117/17